BREAKOUT GROUP (BOG) 3 REPORT:
TESTBED INTERCONNECTION FRAMEWORKS AND ISSUES

1   OBSERVATIONS

There was consensus among BOG 3 attendees that:

- Optical network lightwave-based interconnection services are necessary to meet future terascale applications requirements, because the current router-based Internet architecture is not sufficiently scalable for the provisioning of core network support.

- Agency long-term support commitments are required for the advanced network research activities necessary to develop and deploy dynamic, reliable, and robust optical network services needed to attract next-generation science and application users.

- Existing research testbeds are promising, but are missing a key enabling point: interoperability.

2   DISCUSSIONS

- **Goals of existing and future funded programs should be modified to incorporate a new "interoperability" requirement.** It is recognized that a new objective such as this may in fact run counter to existing project assumptions or goals. Therefore, funding agencies must be made aware of the importance of interoperability and must adjust (expand, redefine, refine, etc.) existing goals to make these interoperations happen.

- **Optical networks in general, but more specifically the target research and education (R&E) optical network testbeds, don't currently interconnect, much less pass common transport and service layer information.** The testbed programs must work together to interconnect their networks. Even the nature of the physical layer "interconnect" is not clear: Is it dark-fiber interconnect? Is it wavelength? Static waves or dynamic? Does it have specific higher layer framing such as SONET or Ethernet? The testbed programs need to define the specific data plane engineering requirements, where and how the topologies meet one another, and where and how the control planes interact.

- **There is no common service definition that forms the basis for the exchange of information among interconnected advanced networks.** So, even were the optical network testbeds to be physically connected with one another, there would not be much that the networks could do for and with each other, as there is no

common vocabulary or protocol which the networks could use to describe their service definitions, capabilities, or requirements among their interconnected service domains.

- **To remedy this situation, an intertestbed working group needs to be established to define an interdomain framework for the exchange of service and transport layer capabilities.** The framework must enable each domain to describe the types of services it can provide, without requiring domains to provide specific services. Service definitions should be developed for the following areas: data transport plane, control plane, services plane, and management plane. The working group should draft a common vocabulary of information to be exchanged among the testbeds, with the focus of promoting the intersection of service areas across testbeds.

- **Success of applications that seek to use advanced optical transport and service capabilities requires global reach.** It is not sufficient to integrate an application with a network testbed and show that the application can take advantage of the technologies. Agencies and partner organizations need to extend their experimental network environments to reach a broader set of users, and a broader set of facilities and sensors. The testbed user community must be expanded beyond the early adopters; to achieve this goal, selected involvement and interconnection with regional and international optical networks and their user communities is critical.

- **There does not yet exist a critical mass for commercial viability of these new, advanced optical networking services.** Long-term viability of advanced optical networks is dependent upon attracting and creating an actively involved user base. The appropriate user base may already exist in a latent sense within the research and engineering (R&E) community, but the selected user science and application programs must be identified and integrated into the network services models.

- **To achieve this crucial goal, agencies and partner organizations must enter into a sustained (long term) mutual commitment that the new network services provided to users will be dependable, robust, and deterministic.** Achieving this is an absolute necessity if the user community is to embrace the new optical networking paradigm, rather than ignoring or even resisting this leap forward. Providing dependable, well-defined services to the user community, so that early feedback on all aspects of optical internetworking can be obtained from real users, will reduce the many years of gestation required for agency science and engineering (S&E) communities to fully achieve the potential that optical networks promise when light-path-based services are finally integrated into the totality of worldwide S&E internetworking.

- **Agency basic network research programs need to consider what it would take to give applications terabit-per-second connectivity.** What would the network look like? What technologies need to be implemented?

3   OVERALL BOG 3 RECOMMENDATIONS

1. ONT programs should adopt optical network testbed interoperability as a primary goal. Agencies should adjust (e.g., refine, expand or redefine) existing goals to assure that these interoperations happen. Agencies and partner organizations should work together to develop and support the multi-agency program relationships needed to interconnect their existing and planned optical network testbeds.

2. A testbed working group should be established by LSN/Internet2 engineering and application managers to define an interdomain framework for the exchange of optical network service and transport layer capabilities between networks and with real users. The working group should identify those domains best suited to begin the task of building this framework for interconnecting independent optical networks and develop some near-term goals to illustrate the benefit of this approach. The framework must enable each domain to describe the types of services it can provide, without requiring domains to provide specific services.

3. Expand the optical network testbed user community beyond the early adopters. To achieve this goal, active involvement of science program funding sources, as well as testbed interconnection with regional and international optical networks and their user communities, are critical. Just as important, there must be a mutual commitment between network providers and the science community that the new network services provided to users will be dependable, robust, and deterministic, so that users will actively embrace the new services and pursue the new science paradigms that will be enabled.